openreach

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Suppliers' Information Note

For The Openreach Network

Ethernet Access Direct (EAD) inc EAD Enable, EAD Sensitive and Ethernet Access Direct Local Access

Service and Interface Description

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1. Introduction

This Suppliers' Information Note (SIN) describes the interface provided with the Openreach Ethernet Access Direct (EAD) services. Also provided is some general information on the EAD product family and some physical aspects of the NTE being deployed for Ethernet Access Direct customer orders.

EAD services are high speed, point-to-point data circuits that are permanently connected and available 24 hours a day, 365 days per year. EAD provides secure links between combinations of end user sites, Communications Providers' (CPs') sites and BT exchanges. EAD Local Access product provides a secure link between an end user site or a CP site and the fibre serving BT exchange site, with the circuit terminating at a CP presence at that serving exchange (e.g. BT Locate space).

Any specific technology mentioned in this document is current as of today. However it may be subject to change in the future. Should the specification of the interface be changed, this will be notified by a new issue of this SIN. Openreach reserves the right to adapt technology to deliver EAD and EAD Local Access services as new developments are made. All services are delivered over an uncontended transmission path.

IMPORTANT:- Please refer to Customer Handbook with regards to safety information for the fibre management tray

2. Service Outline

The EAD service is a point-to-point data service offering high bandwidth connectivity over a standard radial distance up to 25km between sites (23km for EAD sensitive). This radial (or point-to-point) distance can result in physical line plant route distances of up to 40km (36km for EAD Sensitive).

Extended Reach variants are also available with radial (point-to-point) distance up to 45km and route distance up to 86km on the following products (42km radial and 80km route maximum distance for EAD sensitive):-

- On 4U head end NTEs at 10, 100 and 1000 Mbit/s for new EAD orders placed via the Equivalence Management Portal (EMP).
- The new XG120 slim line multi-service head end at speeds of 100, 1000Mbit/s. The XG120 slim line NTE will not offer 10Mbit/s.

EAD offers a secure link between a combination of end user sites, Communications Provider's (CP's) network at a CP's sites and BT exchanges, with the circuit terminating at a CP presence at that serving exchange (e.g. BT Locate space).

EAD Enable and EAD sensitive will support a Communications Provider (CP) to provide their audit/ assurance process in order to offer a Business Impact Level 3 (IL3) service that can be assured to Communications-Electronics Security Group (CESG) level 3-3-4.

By the supply of EAD Enable or EAD sensitive standard IL3 is not guaranteed by Openreach. Such accreditation is the responsibility of the Communications Provider

At a BT site the EAD Enable or EAD sensitive circuit terminates at a CP presence within that serving exchange (e.g. BT Licensed / MUA space) EAD Enable or EAD sensitive can terminate within a MUA space, however the suitability of this as a 'secure' solution should be agreed between the CP and their customer, for example, for a CP to achieve IL3 accreditation it may be possible that the MUA area is not suitable due to the access provided to other customers into this area.

EAD Enable and EAD Sensitive products will NOT be proactively monitored by Openreach. Openreach will provide limited outputs from the NTE to permit the CP to detect alarms, e.g. optional Optical Power Degradation alarm for EAD Enable. EAD sensitive will provide standard port down and PSU alarms directly to the CP, but not degradation alarms. It is the responsibility of the CP to monitor these alarm messages. The CP will need to integrate these alarms with any alarm systems they may have. The CP will be responsible for any initial fault diagnosis activity, using its own diagnostic capability to determine whether a fault is likely to fall within the Openreach access network. A list of those alarms can be found in the product description available on the Openreach web site.

EAD Local Access only provides access as far as the fibre serving exchange and, as this is the only exchange involved, radial distances between exchanges are not applicable. EAD Local Access provides a secure link between either an end user site or Communications Provider's (CP's) network at a CP's site and the fibre serving BT exchange site, with the circuit terminating at a CP presence at that serving exchange (e.g. BT Locate space).

For enquiries concerning connection availability between particular sites and for further information on the EAD service please contact your Openreach Sales Relationship Manager or refer to the EAD Product description, available on the Openreach web site.

The client interface offered on EAD services i.e. the Network Terminating Equipment (NTE) will be dependant on the bandwidth speed selected.

Product Selected		EAD / EAD Local Access 10	EAD / EAD Local Access 100	EAD / EAD Local Access 1000
Interface(s) Offered		10 BASE T*	100 BASE TX	1000 BASE LX (SMF) 1000 BASE SX (MMF)
Connector Types		RJ45	RJ45	Dual LC Single LC RJ45

*NOTE: From April 2021, the XG120 Slim line multi service head end will be launched and will not be offered with 10M services. Existing EAD 4U Head end NTEs and 1U-1U single service NTEs may continue to be ordered with 10M services. EAD Sensitive cannot be ordered with 10M services.

$NOTE: The new XG120 Slim line NTE will also be available with single fibre 1000BASE-BX handover to the customer. Where 1000 BASE BX (Single fibre LC bi-di handover) is ordered for 1000M services, the EAD NTE will transmit at 1310nm [1000BASE BX10-U] towards the Customer. The Customer must transmit back

towards the EAD NTE at 1490nm [1000BASE BX10-D].

Client interfaces offered on the EAD NTE are Full Duplex only. The uncontended transmission path is routed via the Openreach network.

A schematic of the EAD service is shown in Figure 1 and EAD Local Access is shown in Figure 2. The diagrams depict current technology and delivery, and this is subject to change.

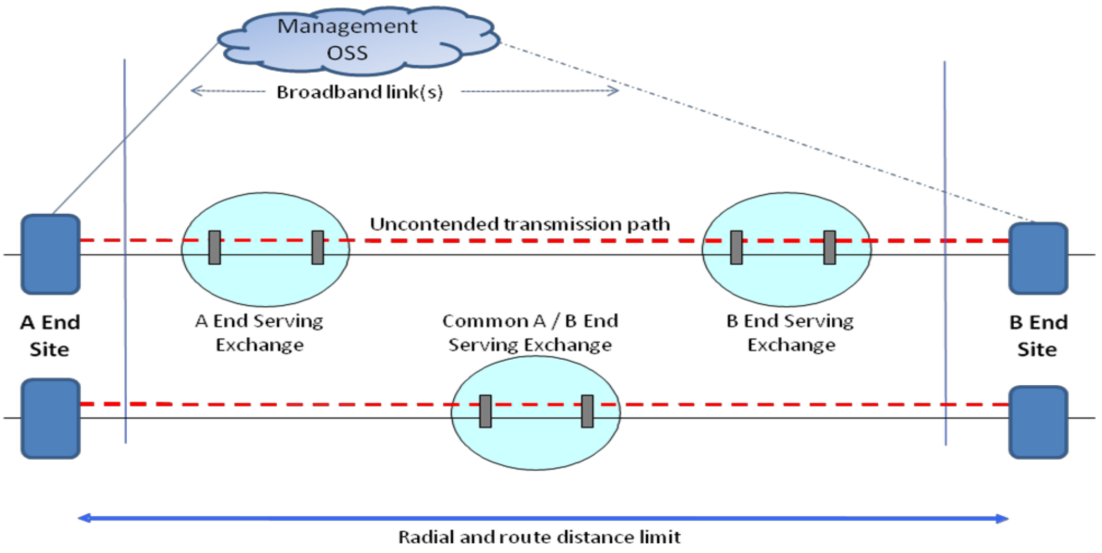

Figure 1. EAD Service Configuration

Note. Figure 1 depicts two separate circuit scenarios, not a combined service. The upper schematic represents an EAD circuit where each end is served from different BT exchanges. The lower schematic represents an EAD circuit where each end has a common BT serving exchange.

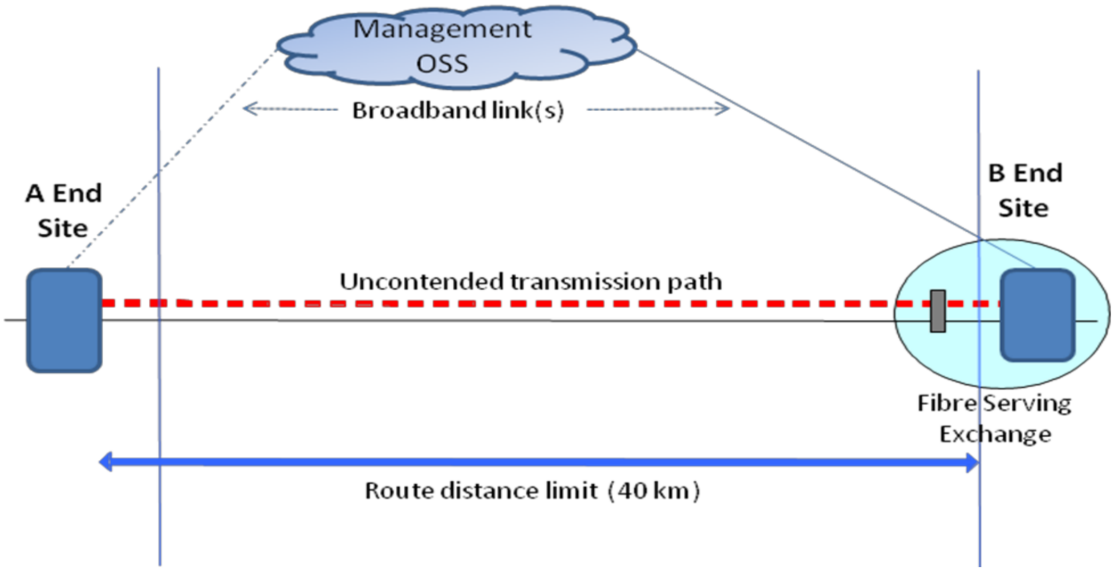

Figure 2. EAD Local Access Service Configuration

Note. Figure 2 depicts an EAD Local Access circuit scenario

Note – EAD Enable and EAD Sensitive have no Openreach management OSS

In most cases EAD/EAD Local Access will be used to interconnect two Ethernet, Fast Ethernet or Gigabit Ethernet LANs on physically distant sites. The EAD/EAD Local Access services are connected for operational support purposes to an Openreach management platform.

3. EAD Service Features

3.1 General

The EAD NTE is capable of transmitting frames conforming to IEEE 802.3[1] with frame sizes from 64 bytes to a maximum of 2000 bytes as specified in IEEE 802.3[1] and amendment IEEE 802.3as[5]. This is to maintain compatibility with a number of frame tagging formats, including VLAN tagging as specified in IEEE 802.1q[4].

The service is transparent to VLAN tags and will forward VLAN tagged frames in the same way as standard (untagged) frames.

Note: The EAD NTE will pass 9000 byte frames on 1000BaseT, 1000BaseLX and 1000BaseSX interface and from April 2021, the XG120 Slim line multi service head end will be launched that passes jumbo frames on 100M, 1000M and 10Gig services (Please refer to SIN 519 for 10Gig services). However as this is not yet a recognized Ethernet standard, BT will not validate usage at this level until such time as the IEEE provide an endorsement and published standard for jumbo frames and we have tested against it.

The new XG120 Slim line multiservice head end supports up to 13 services, of which a maximum of 3 can be 10Gig services (see SIN 519). EAD services offered on this new XG120 Slim line chassis are not offered with an RO1 resilience option, but RO2 may still be ordered.
For services hosted on the new XG120 Slim line multiservice chassis, customers will get 99% throughput (100M) and 99.9% throughput (1000M) for all valid frame sizes with the ability to send untagged, single tagged and double tagged frames. Customers will be able to send outer VLAN tags in range 0-4094 (inclusive). VLAN 4095 will be reserved for internal management and thus cannot be used by the Customer. Incoming traffic from the customer with VLAN 4095 header will be discarded.

EAD Sensitive is only offered with the XG120 Slim line head end the IP of which is owned by ADVA, the PCB design was completed in the USA. Software development, software integration and verification testing was undertaken in the USA and Poland.

3.2 Frame Forwarding Behavior

The EAD service does not include IEEE 802.1d[2] Bridging functionality, which allows for the
Learning and Filtering of traffic packets destined for those hosts connected at the local end.

Therefore Ethernet frames that would normally be filtered by IEEE 802.1d[2]

bridging functionality, are instead forwarded across the EAD link.

3.3 EAD Transparency Restrictions

All Ethernet frames are passed across the EAD link, other than the following list of known exceptions:

1. Transport of EFM OAM PDUs as defined by IEEE 802.3[1] over EAD is not supported

   The EAD service uses EFM OAM PDUs internally for the purposes of OAM. And as per the IEEE802.3[1] standards defined behavior for EFM equipment, the end to end transport of customer EFM OAM PDUs over the EAD link is blocked.

2. Transport of Ethernet flow control / Pause frames over EAD is not supported

3. Transport of Auto-negotiation messages over the EAD link is not supported.

   Auto-negotiation messages are exchanged and terminated between the NTE's client interface and the customer equipment to which it is directly connected.

3.4 Auto-Negotiation and Duplex Settings

The NTE customer interface will require customer equipment Ethernet interface to be set to Auto- negotiate. The NTE will advertise its speed and duplex settings, however the NTE will not allow speed or duplex settings to be set by customer equipment.

However on special request, on the 4U Head-end managed services only, an EAD link can be offered with auto-negotiation switched off at both ends of the link for EAD 10 and EAD 100 services (both EAD standard and EAD local variants. Where such configurations are offered it will be necessary to have customer equipment at both ends of the link set to 10 Full Duplex or 100 Full Duplex (as appropriate) with auto-negotiation switched off. Refer to section 4.1 regarding impact that switching auto-negotiation off, has on MDI/MDI-X auto-cross capability.

Auto-negotiation is mandatory for 1000BaseT, Base 1000BX, 1000 BaseLX and 1000BaseSX, it is not possible to offer these 1000Mbps interfaces without auto-negotiation.

Auto-negotiation operation supported by EAD is specified in IEEE 02.3[1].

The EAD service is 'Full Duplex'. Half duplex operation is not supported by EAD therefore customer equipment must support Full Duplex operation.

3.5 Link Loss Forwarding

The EAD NTE is offered with both Network Link Loss Forwarding and User Link Loss Forwarding. Network Link Loss Forwarding is applied to the service by default. The

User Link Loss Forwarding is a selectable option, as is the link failure notice direction (i.e. A to B end or B to A end).

3.5.1 Network Link Loss Forwarding

When a break is detected on the Openreach network link, the client interface port is shut down to indicate the state of the infrastructure. This continues until such time as the network break is repaired.

3.5.2 User-User Link Loss Forwarding

User-User Link Loss Forwarding allows the notification of failure of a NTE at one end of an EAD service to be propagated to a suitably configured customer device at the other end of the same service. Available as a selectable unidirectional service only, User Link Loss Forwarding is notified at the time of provision.

For EAD customer to CP connections, it is recommended that this functionality is activated from the CP's PoP to the End User customer site. This means that the EAD circuit is only impacted by User Link Loss Forwarding only if problems occur at the CP's equipment at the CP PoP site end of the circuit. If problems occur at the end user customer's equipment, the circuit will not be impacted.

Where User-User Link Loss Forwarding is present on an EAD service the intrusive remote test may not operate correctly unless active customer connection is made at both ends of the service.

4. Customer Interface

4.1 General

This SIN should be read in conjunction with SIN 360, Ethernet Customer Interfaces. The customer equipment Ethernet interface must conform to IEEE 802.3[1], support Full Duplex operation and have auto-negotiation enabled.

10BaseT and 100BaseTX interfaces, can use existing 10BaseT, Category 5 cabling.
1000 BaseT must use Category 5e cabling.
1000BaseBX and 1000BaseLX use single-mode fibre and 1000BaseSX uses multimode fibre.

1000BASE-T requires 4-pair Cat 5/5e cables unlike 10/100baseT which require only a 2 pair cable installation. If only 2-pairs are being used for an existing EAD 10/100 NTE, new Cat5e or higher specification premise cabling will be required when upgrading to 1000Base-T.

The EAD NTE uses MDI/MDI-X autocross capability on the RJ45 port to automatically

compensate for the use of an incorrect cable type, for example if a crossed Cat 5 Ethernet cable if it is used instead of a straight one (or vice-versa). However in the event that the EAD link is configured without auto- negotiation enabled (EAD 4U Modular shelf only), MDI/MDI-X autocross is no longer available on the end of the EAD link terminated by an EAD Modular Shelf The 1U-high NTE used for standard EAD services will still support MDI/MDI-X autocross when auto-negotiation is switched off. The RJ-45 interface on EAD 4U Modular shelf for services configured without auto-negotiation enabled, will have standard pin assignments (Transmit on pins 1 & 2 and receive on pins 3 & 6).

4.2 Connectors for EAD

The client interface is the Network Termination Point (NTP), i.e. the point of connection on the Openreach Network Terminating Equipment (NTE) for connecting CPE or CP equipment. This is the Service demarcation point between the Openreach network and the customers' equipment.

The client interface consists of a RJ-45 type socket for 10 Mbit/s, 100 Mbit/s, 1000 Mbit/s EAD services and single or dual LC sockets for 1000 Mbit/s EAD services. The RJ-45 type connector is as specified in the IEEE 802.3[1] specifications.

The CP or End User provides the suitable connecting cords between the NTE and their own equipment. For Category 5 and 5e cabling this is limited to a maximum cable length of 100 meters. For multimode fibre cabling this is limited to a maximum cable length of 220 meters, in the case of 62.5/125 micron fibre and 500 meters in the case of 50/125 micron fibre. For single-mode fibre cabling this is limited to a maximum cable length of 10000 meters.

Attention is drawn to the Intellectual Property Rights (IPRs) set out in the preface of this agreed International standard. It is the responsibility of the supplier of CPE or CP equipment to ensure that they have the necessary rights from the owner of the IPR. The IPR owner has stated that it is willing to negotiate licenses under reasonable and non-discriminatory terms and conditions with applicants throughout the world.

5. Transmission

The NTEs connected to the Openreach network provide an uncontended transmission path.

6. Environmental specifications

The Temperature and humidity range of the environment used to house the NTEs must not exceed the following:

1. 1U high single service NTEs
2. 0 to 40 degrees Celsius and humidity range of 0 to 90% non-condensing.

The single service 1U NTE has passive cooling

3. 4U high 16-slot NTE chassis
   0 to 40 degrees Celsius and humidity range of 0 to 90% non-condensing.
4. The New 1U high XG120 multi-service NTE

The temperature and humidity range of the environment used to house the 1U XG120 Head end NTE must not exceed the following:

- Ambient housing temperature: 0°C to +45°C
- Relative humidity 5% to 95% (non-condensing)

- The new 1U XG120 Headend NTE has variable speed fan cooling

7. Power Supply

7.1 General

By placing an order with Openreach the customer has accepted the conditions placed by BT. In relation to powering of equipment, the customer must comply with the requirements of BS7671 [14] and the details giving within the 'DC Power Planning and Installation Guide for WES-BES Products' document.

The Openreach NTE is locally powered and offers AC or DC power options. The CP will be required to provide either dual local 50 Hz AC supply in the form of standard 13 Amp power socket(s); or dual -48V DC power distributions and Earth connections, with all wiring colour schemes conforming to BS7671 [14] (IEEE Wiring Regulations). It will be the customers' responsibility to ensure that the power supplies are fused and safe for Openreach to use. These should be in close proximity to the NTE Installation location.

7.2 Installation and Testing

In addition to the NTE and Chassis powering requirements below, a spare 50Hz AC mains supply
13A socket should also be provided in close proximity to the NTEs, to power BT test equipment during both initial commissioning and subsequent maintenance support activities. A 50Hz AC mains supply 13A socket should also be provided in close proximity to the NTE for the management router. Note: For cases where an EAD circuit is delivered using a 4U Modular chassis at both ends of the link, a management router connection will be required at both ends. The new XG120 Slim line multiservice NTE will require a management router connection if it is designated a hub end. Remote end XG120 NTEs (i.e. without a management router connection) will require their first provisioned circuit to have the other end of that circuit connected to a hub end XG120 for management purposes.

7.3 AC Power Connection

AC power connection between Openreach equipment and the power socket will be made using a standard IEC320 C13-14 power lead fitted with a standard 13A plug, this is Low Smoke, Zero Halogen. The NTE itself has dual power supply units internally, and requires two AC mains supply socket running off the same phase.

- **For most installations:**
  This will require two mains connections for each NTE provided, and the consumption of the Openreach NTE and power unit chassis in this managed service arrangement will be no more than 50 Watts per NTE. An additional AC mains supply socket will be required for the management router.

- **For larger installations (at Openreach discretion):**
  At Openreach's discretion, where a large number of systems of one type are being deployed, a 15-slot Modular NTE or the new XG120 slim line NTE may be deployed. This will require two mains connections for each modular/multiservice chassis provided. The consumption with a maximum number of 15 service cards provided will be no more than 220 Watts per chassis and for the new XG120 Slim line NTE no more than 120 Watts per chassis. An additional AC mains supply socket will be required for the management router.

7.4 DC Power Connection

The DC In-Line (Molex) connector is specified as the standard method of connecting DC power by Openreach, and represents the "Demarcation Point" between Openreach and the customer. At its site, the customer is required to provide suitable power and earth connection to, and be responsible for the supply, wiring and labelling to, the demarcation point. Openreach will not supply or install the DC distribution system as part of the standard Ethernet installation. EAD Sensitive is provided with this DC In-Line (Molex) lead, which is not Low Smoke, Zero Halogen.

- **Customer-provided wiring up to the Openreach specified In-Line connector**

  Wiring, MCB isolation or fuse (i.e. C Type MCB or Cartage Fuse), must be provided by the customer, up to and including the DC in-line connector, as per BT's requirements stated within the 'AC/DC Power Planning and Installation Guide document with respect to;

  i. Correctly rated MCB/Fuse,
  ii. Correct labelling of wiring and MCB/fuse positions compliant with BS 7671 [14],
  iii. Correct size of cable for required voltage drop at required maximum current,
  iv. Separately fused isolatable A & B power supplies, as detailed in the 'AC/DC Power Planning and Installation Guide document.

  An additional AC mains supply socket will be required for the management router. Currently the management router is AC powered only.

7.5 Additional Details

For further details on the provision of DC Power, see the 'AC/DC Power Planning and Installation Guide ' available on the Openreach Ethernet website.

If there is a conflict between DC power information contained in the 'AC/DC Power Planning and Installation Guide and the SIN document, the order of precedence shall be as follows:

(a) AC/DC Power Planning and Installation Guide
(b) SIN

8. Further Information

For enquiries concerning connection availability between particular sites and for further 'sales and marketing' information on EAD services, please contact your Openreach Sales relationship Manager, or see the Openreach site listed on the SINet Useful Contacts page at https://www.openreach.co.uk/orpg/home/helpandsupport/sins/sins.do

9. References

[1]	IEEE 802.3	IEEE standards for Local and Metropolitan Area Networks-Carrier Sense Multiple Access with Collision Detection (CSMA/CD) access method and physical layer	2005
[2]	IEEE	IEEE Recommendations for Bridging: Learning and	-
[3]	IEEE 802.3x	IEEE Standards for Local and Metropolitan Area Networks: Specification for 802.3 Full Duplex	1997
[4]	IEEE	IEEE Recommendations for Virtual LANs	1998
[5]	IEEE 802.3as	IEEE standards for Local and Metropolitan Area Networks-Carrier Sense Multiple Access with Collision Detection (CSMA/CD) access method and physical layer specifications Amendment 3: Frame format extensions	2006
[6]	ITU-T G.8261	Timing and Synchronization Aspects in Packet Networks	
[7]	ITU-T G.8262	Timing characteristics of a synchronous Ethernet equipment slave clock	
[8]	ITU-T G.8264	Distribution of timing information through packet networks	
[9]	ITU-T G.703 (2M)	Physical/electrical characteristics of hierarchical digital interfaces	
[12]	EN 300 386	Telecommunication network equipment; ElectroMagnetic Compatibility (EMC) requirements	2016
[13]	IEEE 1588-2008	IEEE Standard for a Precision Clock Synchronization Protocol for Networked Measurement and Control Systems	2008
[14]	BS7671	Requirements for electrical installations. IEE Wiring Regulations. Eighteenth edition	2016

For further information or copies of referenced sources, please see document sources at:
https://www.openreach.co.uk/orpg/home/helpandsupport/sins/sins.do

10. Abbreviations

100BaseT	100Mbit/s twisted pair interface defined in IEEE 802.3
10BaseT	10Mbit/s Base-band twisted pair "Ethernet/IEEE 802.3" technology
1000Base	1000Mbit/s twisted pair interface defined in IEEE 802.3
CP	Communications Provider (Providers of Electronic
CPE	Customer Premises Equipment
CSMA/CD	Carrier Sense Multiple Access / Collision Detection
EAD	Ethernet Access Direct
EFM	Ethernet in the First Mile
ESM	Ethernet Synchronization Message
IPR	Intellectual Property Rights
ITU-T	International Telecommunications Union For Telecommunications (formerly
LAN	Local Area Network
LLF	Link Loss Forwarding
MAC	Media Access Control (& Hardware Device Address)
Mbit/s	Mega (10^6) bits per second
MCB	Mini Circuit Breaker
MDI	Medium Dependent Interface
MDI –X	Medium Dependent Interface Crossover
NTE	Network Terminating Equipment
NTP	Network Terminating Point
OAM	Operations Administration and Management
PDU	Protocol Data Unit
SIN	Suppliers' Information Note
SSM	Sync Status Message
VLAN	Virtual Local Area network
VoIP	Voice Over Internet Protocol (application)

11.History

Issue	Date	Details
Issue 1.0	25 March 2009	First issue
Issue 1.1	29 May 2009	Specified the AC mains power sockets required for the
Issue 1.2	12 November	General document update following Industry
Issue 1.3	13 November	Editorial corrections to the Contents list
Issue 1.4	19 October 2010	Updated due to the launch of a new product feature on EAD, allowing auto negotiate to be turned off
Issue 1.5	October 2011	Updated due to the launch of EAD Enable
Issue 1.6	August 2012	Addition of text relating to EAD Extended Reach. Correction of chassis temperature upper limit in section 6; Correction of URL of AC/DC power guide. And Correction of term '16-slot chassis' to refer to '15-slot chassis instead'.
Issue 1.7	August 2013	Update to text relating to EAD Extended Reach products
Issue 1.8	April2014	Update to include SyncE and change of SINet site URL.
Issue 1.9	November 2018	Various minor textual errors corrected and links updated
Issue 2.0	May 2020	1000 BaseT added as interface option
Issue 2.1	November 2020	Openreach brand changes made, inclusion of 1Gig RJ45 handover and removal of SyncE.
Issue 2.2	March 2021	Inclusion of XG120 slim line multi service NTE
Issue 2.3	February 2022	Inclusion of EAD Sensitive product details update formatting and BT address.
Issue 2.4	March 2022	Minor text change to remove incorrect Date availability of XG120 slim-line headend NTE
Issue 2.4	March 2023	Annual Review – branding and font changes only – issue remains unchanged.
Issue 2.4	June 2024	Annual Review – branding and font changes only – issue remains unchanged.

-END-